

# Lesson/Week II

- ➔ **Measuring Population Growth and Change**
- ➔ **World Population Growth**
- ➔ **The Three Major Periods of Population Growth**
- ➔ **The Human Population Today**
- ➔ **US Population Projections**

# POPULATION GROWTH AND CHANGE

## Key Terms:

- Population growth
- **Basic Demographic Equation**
- Rate of Natural Increase
- Doubling time
- Carrying Capacity
- Population Projection
- Mathematical methods
- Component methods
- Baby boom

**\*\* The most fundamental characteristic of a population is its **Size****

**Could the US have been a super power if it only had a population of 50 million? If not why not?**

**Which nation is now referred to as the emerging super power?**

**Does its population size have anything to do with this description?**

# The **Basic** Demographic Equation

Do all populations change?

Two types of change:

➤ **Change in numbers**

➤ **Change in characteristics**

Understanding change in numbers (the Basic Demographic Equation)

$$\mathbf{FP = SP + B - D + I - O}$$

**FP** = Final (future) population

**SP** = Starting population

**B** = Births during interval

**D** = Deaths during interval

**I** = In-migration during the interval

**O** = Out-migration during the interval

## Change in Numbers

1. Individuals **enter** the population:  
Births + In-migration

2. Individuals **leave** the population:  
Deaths + Out-migration

$(1 - 2) =$  Net population increase/  
decrease

# Two Types of Population Increase/ Growth:

1. **Natural increase/growth** (takes account of **births and deaths only**)

2. **Total increase/growth** (takes account of **births, deaths, in-migrations, and out-migrations**)

**Therefore:**

**The rate of natural increase (RNI) is defined as**

$$\mathbf{RNI = CBR - CDR}$$

**where:**

**BR = Birth rate**

**DR = Death rate**

**C: stands for the word “crude”**

$$\text{CBR} = (B/P) \times 1000$$

where: B = Number of births in one  
year

P = Mid-year population



$$\text{CDR} = (D/P) \times 1000$$

where: D = Number of deaths in one  
year

P = Mid-year population

**CBR World, 2008 = 21**

**Total mid-year population  
6,705,000,000**

**Calculate:  
No. births**

**Number of births = Total  
mid-year population x CBR**

**= 6,705,000,000 x 0.021**

**= 140,805,000**

**CDR World, 2008 = 8**

**Total mid-year population**

**6,705,000,000**

**Calculate:  
No. deaths**

**Number of deaths = Total  
mid-year population x CDR**

**= 6,705,000,000 x 0.008**

**= 53,640,000**

# Net population increase: World, 2008

$$= 140,805,000 - 53,640,000$$

(births – deaths)

$$= 87,165,000$$

# **RNI (world)**

$$= \text{CBR (world)} - \text{CDR (world)}$$

$$= 21 - 8$$

$$= 13 \text{ (per thousand)}$$

**or 1.3 percent**

**\*\* There is an average net increase of 1.3 persons in every community of 100 people around the world**

**Number of persons added (or lost) in a  
community of 100 (natural increase):  
(2008)**

**USA : 0.6**

**Ethiopia: 2.5**

**Sweden: 0.2**

**Palestinian Territories: 3.3**

**Estonia: -0.1**

**Latvia: -0.4**

**Bulgaria: -0.5**

**Ukraine: -0.6**



# **Doubling time:**

**is the number of years that would be required for a population to double in size, assuming that the population continues to grow at a given annual rate.**

**\*\*It is like your money in the bank that is earning interest. It will double sooner or later depending on your interest rate.**

**You can calculate the doubling time for your money using mathematical formulas, but an easy approximation can be achieved by dividing the annual rate of growth into the number 70. If you are earning a 2% interest, the doubling time would be  $70 \div 2 = 35$  years**

**\*\*Same thing applies to populations.**

**US Population Doubling Time**

**= 70 ÷ US growth rate (%)**

**US Growth Rate =**

**Natural increase + Net Migration**

**= 0.6 + 0.4 = 1.0**

**US doubling time = 70 ÷ 1**

**= 70 Years**

**Ethiopia: 28 years**

# WORLD POPULATION GROWTH

- \*\* About 80 million people are being added to what many already perceived to be an **overcrowded planet**.**
- \*\* Every four years, more people are added to the world population than currently live in the United States.**
- \*\* However, for most of human demographic history population growth was exceedingly slow.**
- \*\* The annual rate of increase probably did not reach 0.1 percent (a doubling time of about 700 years ) until sometime in the seventeenth century.**

**\*\* Our knowledge of historical population sizes and growth rates remain speculative because censuses and other organized and systematic collection of population data were nearly nonexistent before the middle of the eighteenth century.**

**Estimates of population numbers in prehistoric times vary considerably and are generally made on the basis of assumptions about **the carrying capacity of the land** – its capacity to sustain a given human population at a given level of technology – and the distribution of the human population.**

**World population around one  
million years ago: 125,000**

**25,000 years ago: 3.34 Million**

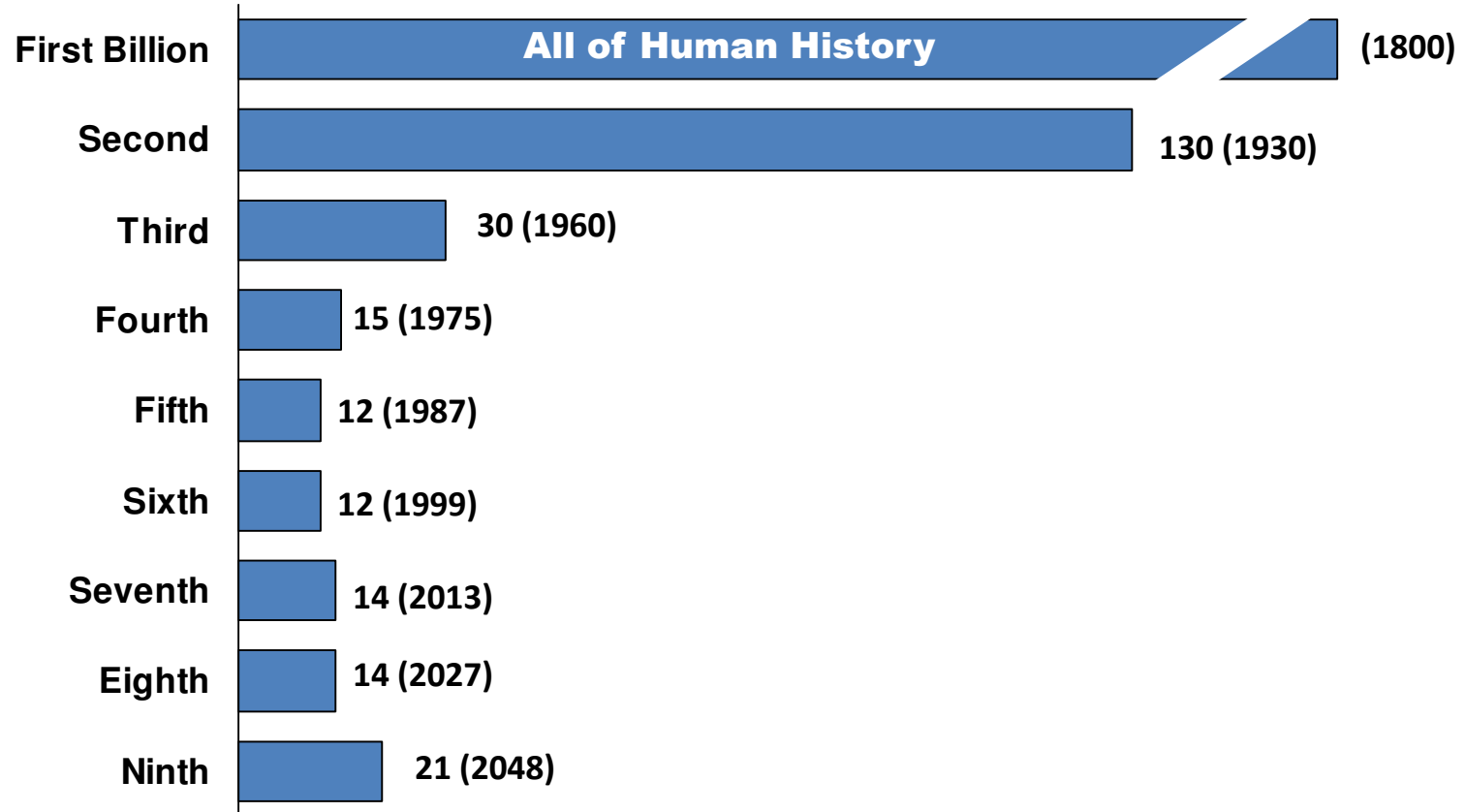
**10,000 years ago 5.32 million**

**250-300 million by AD1**

**Deevey (1960) (text p. 4)**

# World Population Growth, in Billions

Number of years to add each billion (year)



Sources: First and second billion: Population Reference Bureau. Third through ninth billion: United Nations, *World Population Prospects: The 2004 Revision* (medium scenario), 2005.



**\*\* The world population growth rate peaked sometime in the late 1960s at around 2.1 percent, from which it has dropped gradually to a level of about 1.2 today.**

**How many people have ever  
lived on planet earth?**

**Answer: An estimated 106.5  
Billion people had been born  
by 2002, 6 percent of whom  
(6.125 billion people) were  
alive in 2002**

# Two ways to look at the history of population numbers

- 1. Increase in population numbers over time due to changes in growth rates**
- 2. Changes in the rate of increase itself** (see Fig. 1-2 p.6)

## History:

The three major periods of population growth:

- **The Cultural revolution**
- **The Agricultural revolution**
- **The Industrial revolution**

# The Cultural revolution:

Emergence of primates – 85 mill. Years ago  
Humans diverged from chimpanzees (our closest living relatives) – 8 million years ago

## Hominids (marked by bipedalism)

- Ardipithicus ramidus kadaba* - 5.5-5.8 million years
- Ardipithicus ramidus ramidus* – 4.4 million years
- Australopithecus anamensis* 4.2 million years
- Australopithecus afarensis* - 4.1 million years (LUCY)
  
- Homo habilis* – 1.6 – 2.2 million years
- Homo erectus* 1.4 to 1.7 million years
- Homo neanderthalis*
- Homo sapienes sapiense*

# Videos

<http://www.becominghuman.org/>

[http://www.youtube.com/watch?v=ahl  
oeBhlcYk&feature=related](http://www.youtube.com/watch?v=ahl<br/>oeBhlcYk&feature=related)

**“...the maternal lineage of all humans could be traced back to a single African woman who was alive perhaps 200,000 years ago...”**

**“...a woman now referred to by many as ‘Mitochondrial Eve’  
...based on studies of mitochondrial DNA...”**

## **More statements on the African Connection**

**“The oldest fossil of a modern human so far was discovered in...Ethiopia where it lived 195,000 years ago”**

**“Perhaps the most wonderful of the stories hidden in our genes is that, when unraveled, the tangled knot of our global genetic diversity today leads us all back to a recent yesterday, together in Africa”**



**“...the successful migration of modern humans out of Africa and around the world began between about 70,000 to 50,000 years ago...reaching Australia by about 50,000 years ago.”**

**Between 30,000 and 40,000 years ago modern humans appeared in Europe, where Neanderthals lived already”**

# The role of culture

**“...the final defining characteristic that gave modern humans their edge over the Neanderthals may have been the development of language and the ability to form mental symbols”**

# The Agricultural Revolution

Exact date of the start of agriculture is not known

Probably sometimes around 10,000 B.C.

Made possible by good climate following the ice age?

“The rim-land around the **Fertile Crescent** was one of the first areas to experience the agricultural changes that would slowly burgeon into a major revolution”

# Fertile Crescent



Source: <http://davidderrick.wordpress.com/2007/09/08/the-fertile-crescent/>

## The revolution brought about:

- \* The domestication of plants and animals
- \* Sedentary life
- \* Transition from rural to urban
- \* First food surpluses
- \* Greater population density
- \* Irrigation
- \* A multitude of inventions and innovations
- \* Short- and long-distance trade
- \* Increased carrying capacity of land
- \* Rise of early cities

**“The demographic response to agricultural and related changes was a gradual acceleration in the rate of population growth”**

**Gradually, “... the population growth slowed again, and the population stabilized at a new and higher plateau”**

The rate of population growth was kept in check by availability of food supplies (often interrupted by famines), wars, and by epidemics of various diseases.

## FAMINES

“Fourteenth century China may have experienced the planet’s first great famine (with deaths thought to be in excess of 4 million).”

**Famines occurred in many regions over the next few centuries including the great potato famines in Ireland (1845-49).**

**In the 20<sup>th</sup> century:**

**China, India, Russia, Poland, Greece, Africa's Sahel region, Ethiopia, Bangladesh, Somalia, Nigeria, Cambodia.**



# WARS

**“The simple accounting of battlefield deaths alone would underestimate the demographic impact of most wars, because wars also disrupt food supplies and act as diffusion agents for numerous diseases”. Disrupted fertility is another major consequence of war.**

**The greatest war loses in human history occurred in World War I and World War II**

# **DISEASES**

**The Black Death (plague) of 1346-1348 may have reduced the European population by 25%, and in numbers may have gone down in some localities by 50%.**

**“...95% of the Native American population died as a result of diseases introduced by Europeans into the New World”.**

# The Industrial Revolution

**“The Industrial Revolution originated in **England** in the later half of the eighteenth century, though its roots may be found in earlier times.”**

**“At the heart of the Industrial Revolution was **a shift from animate to inanimate energy sources**, from humans and domesticated animals to steam power generated by carbon fuels – charcoal, coal, and later on oil and natural gas”**

**The revolution underwent a geographic dispersion that continues to this day.**

**“During both the cultural and agricultural revolutions people increased their capacity to wrest a living from the earth, but it was not until the scientific industrial revolution that, for the first time, that they began to gain control over earth”**

## Control over death rates through:

**\*\* ...better Agriculture (to prevent famine)**

**\*\* ...improved sanitary practices**

**\*\* ...medical advances**

## Control over birth rates through:

**\* ...Contraception.**

**\* ...Late marriage/childbearing**

**\* ...Long birth intervals.**

## 19<sup>th</sup> century:

**\*\* Most growth was in present-day developed countries**

## 20<sup>th</sup> century:

**\*\* Most growth in developing countries**

**World population at the end of the 19<sup>th</sup> century : 1.6 billion**

**World Population at the end of the 20<sup>th</sup> century: 6.1 billion**

**“...economists have suggested that the world’s material standard of living increased perhaps nine-fold during the 20<sup>th</sup> century...”**

**On average, people live longer, healthier lives now than they did a hundred years ago.**

**“Geographically, however, the vast improvement in wealth during the twentieth century accrued mainly to nations of Europe, the United States and Japan.”**

**“We enter the new century with vast differences in wealth among the world’s nations – a person’s place of birth largely determines his or her economic and demographic destiny.”**



# Summary (1):

**After each rapid spurt in population growth following the three revolutions, the growth rate slackened off – the numbers reached a plateau, and then further additions were slow to be achieved.**

## Summary (2):

**“Each revolution, therefore removed, partially at least, some pre-existing constraint upon population growth, but it must also have set in motion forces that eventually brought growth under control”**

**By the way, there are population groups around the world, albeit very small in sizes, who have not undergone any revolution at all except cultural (i.e. they have evolved into modern humans, that's all).**

**Most African countries have not completed the agrarian revolution yet.**

# Human Population Today

## **This decade and next**

**\*\* Growth rates still high**

**\*\* A large base (6.7 billion people)**

**\*\* 90% percent of new additions in the developing countries of the world**

**\*\* Africa is the fastest growing continent**

**\*\* Death rates are falling everywhere**

**\*\* By 2005, 81% of the world population resided in the developing countries; nearly half are citizens of either China or India**

**\*\* International migration is redistributing global population predominantly from south to north**

# Population projection

- We should be careful to differentiate between projections and predictions.
- The projection for a size of the population at some future date is based on a set of assumptions about the demographic processes that will affect future population growth.
- The simplest assumption is that future rate of growth will be the same as today's
- Typically, separate projections are made for births, deaths, and migrations.
- “Usually more than one projection is made and quite often a series of projections are made using different assumptions : High variant, Medium variant, Low variant

# Two Broad Classes of Projection Methods

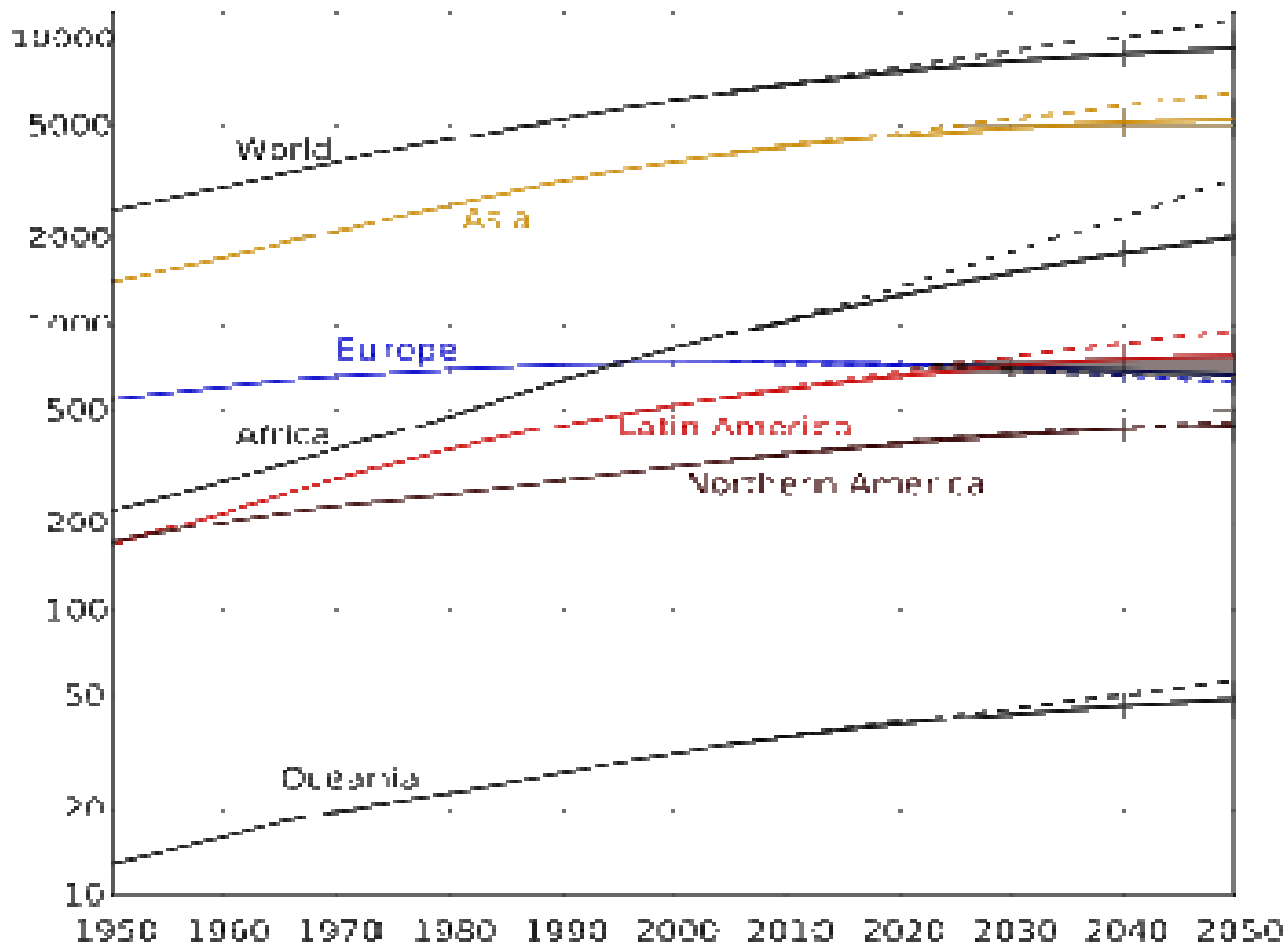


- Mathematical method
- Component method

**“Whereas **mathematical methods** employ some mathematical formula to a base population using an assumed rate of growth over the projection interval, **component models** separately project births, deaths and migrations, then combine the ‘components’ into an overall population projection”**

- **Within each class of projections different models exist.**
  - **The model to be used depends on factors such as the size of the area or the population (for example, national vs. sub-national) , and the length of the projection interval.**
  - **Understanding and projecting migrations is more critical for local area projections than is the projection of births and deaths.**
    - **Data for local areas are not always available in sufficient detail for employing component models, thus making mathematical models more attractive.**
  - **Population projections can stimulate our thinking about the consequences of population trends.**
- **Generally, the future course of fertility is more difficult to project than that of mortality.**





# Projected population (2050)

## Population Sizes in 2050 According to Different Projection Variants

	Low	Medium	High	Constant
World	7,920,000,000	9,191,000,000	10,756,000,000	11,858,000,000
North America	382,000,000	445,000,000	517,000,000	460,000,000

**Note:** In 1950 Europe had more than twice the population size of Africa

In 2050 Africa will have tripple the population size of Europe (medium and high variant), or five times the population size of Eoruope (constant variant)

**“Despite the difficulties, population projections are deemed essential and useful. **The can stimulate our thinking** about the **consequences** of population trends, for example.”**

## **Review of today's lesson:**

- 1) What have you learned today?**
- 2) What are your comments on today's lesson regarding historical population growth rates, and future trends?**
- 3) Are there other growth-related issues you wish to raise before today's lesson is over?**

**END of LESSON 2**